

F. ELLERSHAUSEN.
Making Iron and Steel.

No. 77,722.

Patented May 12, 1868.

Fig. 1.

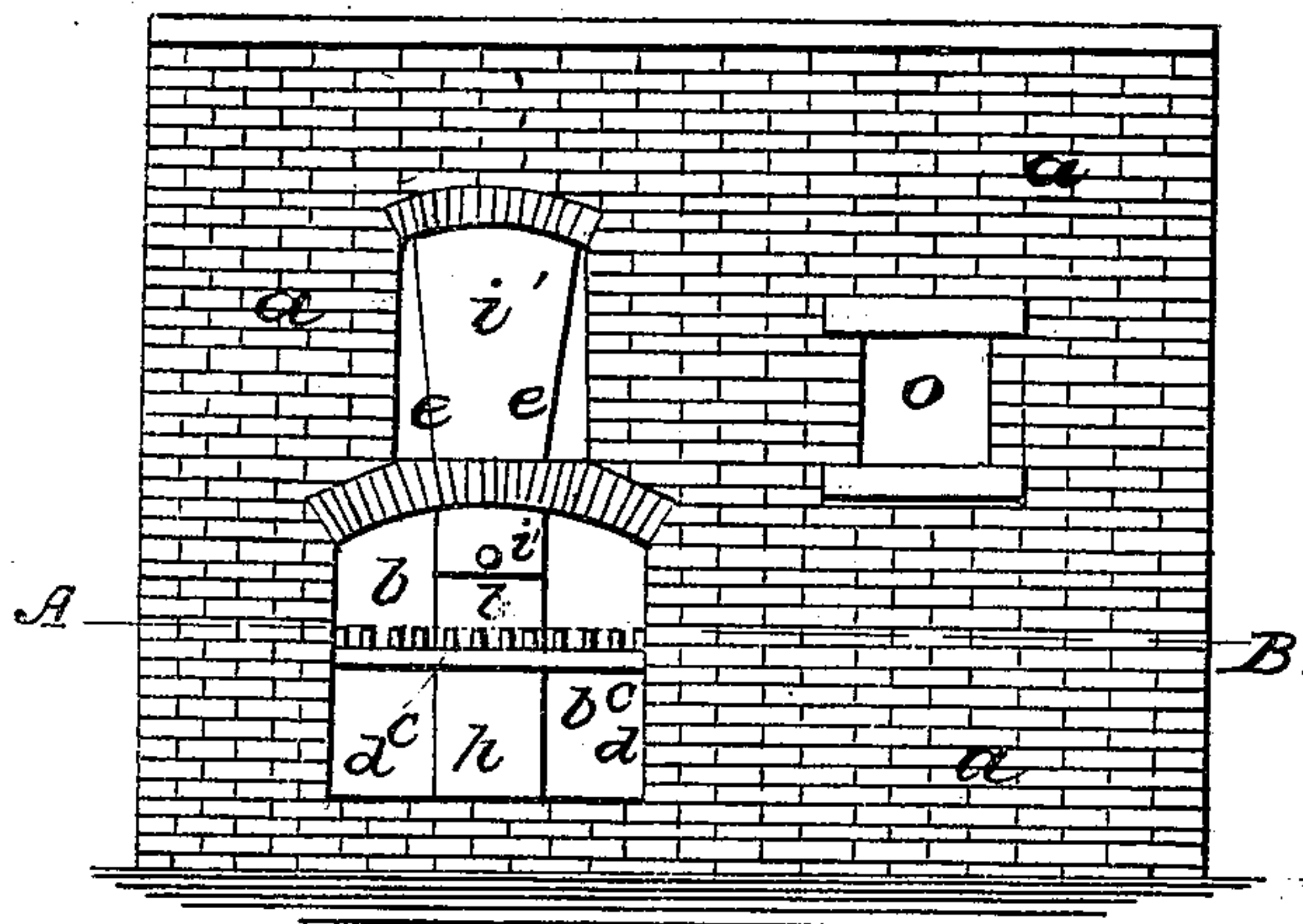


Fig. 3

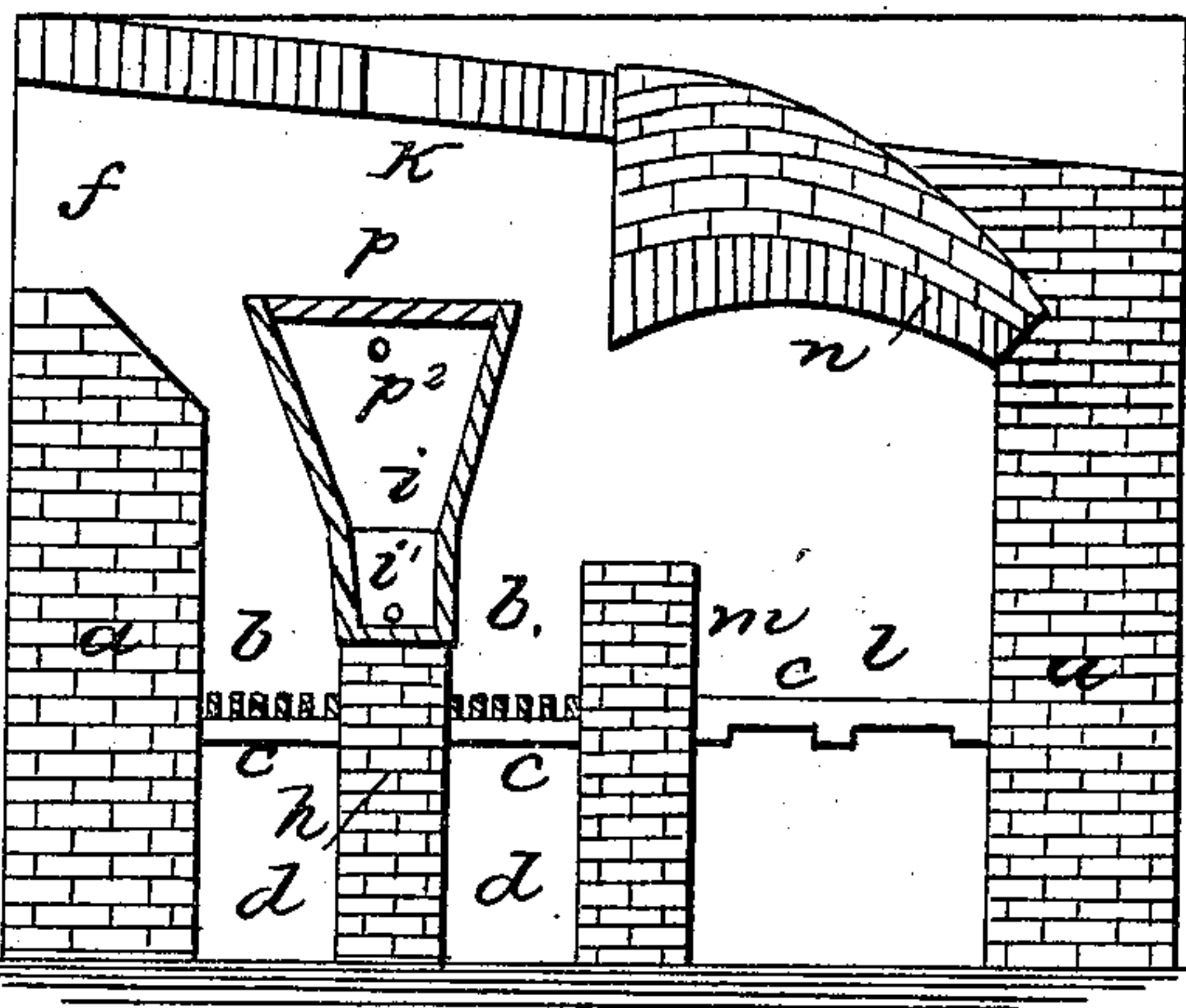


Fig. 2.

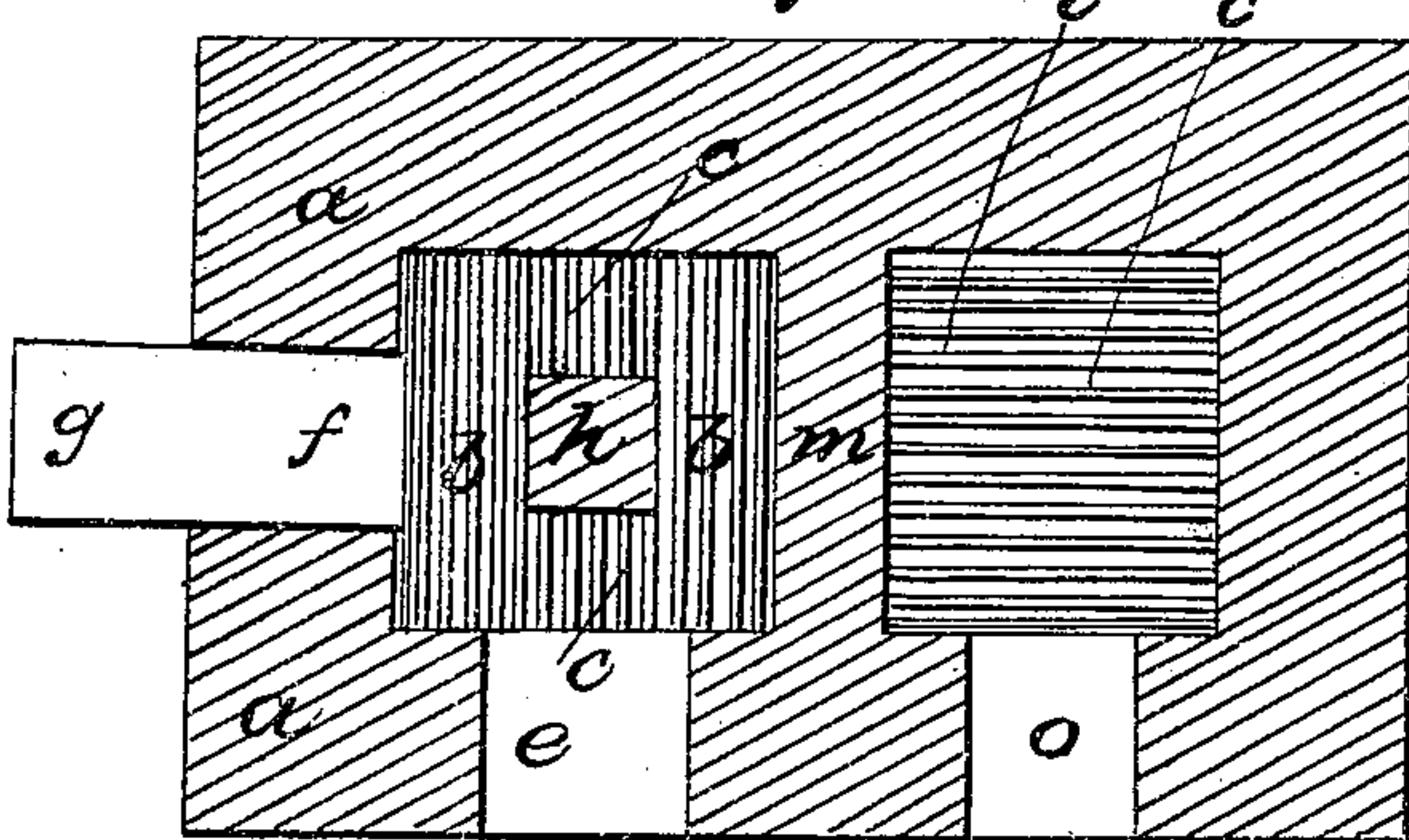
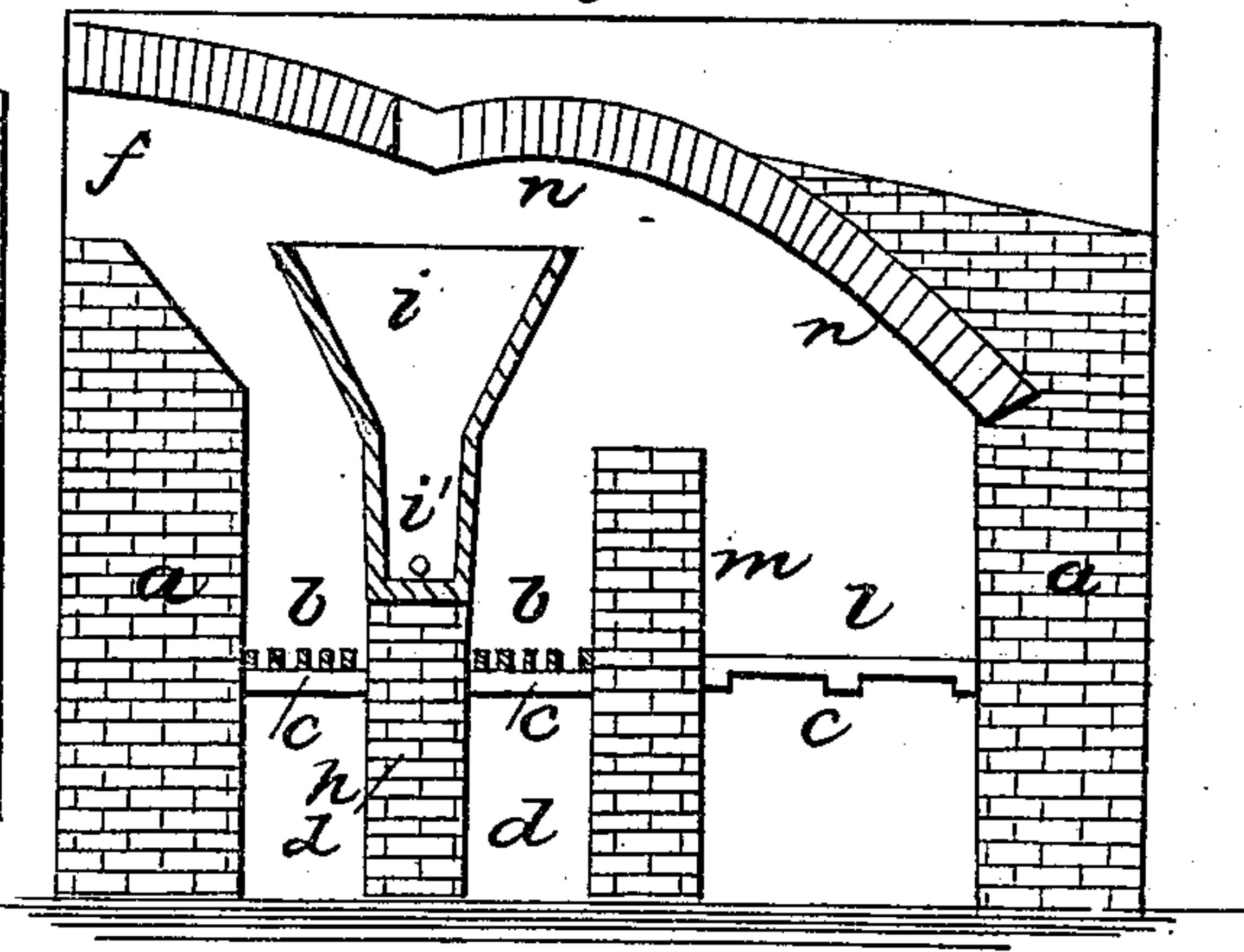


Fig. 4



WITNESSES

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FRANCIS ELLERSHAUSEN, OF MONTREAL, CANADA.

Letters Patent No. 77,722, dated May 12, 1868.

IMPROVEMENT IN FURNACES AND PROCESSES FOR THE MANUFACTURE OF IRON AND STEEL.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, FRANCIS ELLERSHAUSEN, of Montreal, Canada, have invented a new and improved Furnace for the Manufacture of Cast Steel from Cast and Pig-Iron; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a side elevation of the furnace.

Figure 2 represents a horizontal section of the furnace through the fire-bars on line A B.

Figure 3 represents a vertical longitudinal section through the furnace.

Figure 4 represents a vertical longitudinal section of a modification of the roof of the fire-chambers in furnace.

Similar letters of reference indicate corresponding parts.

This invention relates to a new furnace for the manufacture of cast steel from pig-iron, in conjunction with wrought iron or iron ore, and for the purpose of smelting blistered steel in large quantities and resmelting metals in general.

The invention consists, first, in the novel combination of two fire-chambers, which are separated by a bridge, a large crucible being set up in one chamber, the fire in which chamber surrounds the crucible, while the other is a reverberatory fire-chamber, by means of which the heat around the crucible is brought to an extreme degree.

The invention consists, second, in the employment of large crucibles, which are provided with discharge-holes through their sides, and in which large quantities of metal can, in a short time, be smelted.

The invention finally consists in a new process of producing cast steel by placing cast iron in a large crucible, of the aforesaid description, as will hereinafter be more fully described.

By the use of my improved furnace, a degree of temperature can be obtained greatly in excess of any degree of heat heretofore produced in crucible or reverberatory furnaces used in the manufacture of steel.

Thus a crucible of two inches in thickness, and sufficiently large to contain one thousand pounds of metal, will convert this quantity in half the time now occupied in smelting the metal contained in a crucible which holds no more than fifty pounds; and by my invention the heated crucible will stand for many days' work, as the temperature of the same is not varied. As I am enabled to tap the crucible, the operation can be continued without interruption as long as the crucible will hold.

Letter *a* represents the shell of the furnace, which may be built, in the form shown in the drawing, of ordinary bricks or stones, but lined on the inside with fire-bricks. It will be strengthened by an iron casing on the outer side. *b* is the principal fire-chamber, supplied with coke or anthracite coal, and is provided with grate-bars *c c*, ash-pits *d d*, and door *e*, for the admission of fuel and of the crucible. *f* is the outlet for the fire-chambers into the chimney *g*. *h* is a stand for the support of the crucible, built of fire-brick, and of sufficient size for any convenient dimension of crucible employed. *i* is the crucible referred to. The same is of large size, and is perforated near the bottom, as at *i'*. *k* is the aperture in the roof of the furnace immediately above the mouth of the crucible. This aperture is also made use of for the manipulation of the material in the crucible during the process of conversion. *p* is the cover of the crucible used in fig. 3, and *p*² is the upper hole in the crucible for discharging the slag. *l* is a second fire-chamber, separated from the first fire-chamber, *b*, by the fire-bridge *m*. This second fire-chamber is also provided with the requisite grate-bars and ash-pit, but with an arched roof, as shown at *n*. *o* is the door for the admission of fuel into the fire-chamber, which, in this case, must consist of bituminous coal, for the purpose of creating a flame. Both of these fire-chambers are supplied with air-pipes from a fan-blast, for facilitating the combustion.

In a modification shown in fig. 4, it will be seen that the configuration of the roof of each fire-chamber differs in some respects from that shown in the other figures, being arched for the purpose of throwing the flame from the second fire-chamber *l* into the mouth of the crucible, while in fig. 3 the reverberatory fire is to increase the heat on and around the crucible.

I will now proceed to describe the mode of operation.

In the furnace shown in figs. 1, 2, and 3, the *modus operandi* is as follows: After both fires are started, and the furnace brought to a white heat, molten cast iron is poured into the crucible, in such quantities as will form steel of the required quality, in conjunction with malleable iron. After the introduction of cast iron, vitreous fluxes are introduced, in order to protect the metal from oxygenation. Wrought-iron scraps are then brought to a white heat in an adjoining furnace, and are slowly introduced, in suitable quantities, into the cast iron already in the crucible, and the same is melted by contact with the cast iron. When the proper proportions of cast and wrought iron have been thus mixed in the crucible, and a proper fusion secured, the metal is drawn off, as cast steel, through the discharge-pipe *z'*, and the process repeated.

The next and important use of my improved furnace is its capacity for smelting and refining blistered or any other steel, or any other metals desired to be resmelted or refined, as my furnace will do the same work in less than half the time, and in far larger quantities during each operation.

In the modification of furnace shown in fig. 4, the well-known puddling process is followed, with the following modifications: The working-hole is on the top of the furnace instead of on the side. The puddling itself is done by means of a ball of iron attached to the end of an iron bar, operated in a vertical direction, by a pulley and chain or by hand. The crucible takes the place of the hearth, and in doing so the hearth or crucible is heated from the reverberatory fire, and at the same time assisted by the fire around the crucible, producing an intense heat. When the interior of the chambers is at a white heat, a quantity of cast iron is introduced into the crucible, and the puddling process begins, and sufficient quantities of pulverized iron ore are mixed with purifying fluxes or agents, and pulverized charcoal is introduced by degrees through the feed-hole *K*, and worked up with the melted cast iron until the metal comes to "nature" or becomes "pasty." The slag is then run off through the slag-hole, and the required proportion of cast iron added to form the required quality of steel. The cover is either put on the crucible, or vitreous flux is added, to prevent the oxidation of the steel, and the blast increased in the fire-chamber *b*. The cast iron last added will carbonize the pasty material before alluded to, and the whole will become liquid, and after allowing sufficient time for fusing, the cast steel is ready for drawing off.

I do not confine myself to the precise details herein set forth, as they may be slightly varied to suit circumstances, in form of furnace employed, and various qualities of steel to be manufactured; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The furnace, in its novel combination of two fire-chambers, *b* and *l*, separated by fire-bridge *m*, as shown in the two modifications, one chamber being a crucible fire-chamber, and the other a reverberatory fire-chamber, both in connection with the crucible *i*, all working together, substantially in the manner and for the purpose described.

2. The process of smelting and refining metals in large quantities and in short time, by the employment of a large crucible with discharge-hole.

3. The puddling of cast iron in a crucible placed in my furnace, and surrounded by fire, the product being cast steel, substantially in the manner described.

The above specification of my invention signed by me, this 6th day of April, 1868.

FRANCIS ELLERSHAUSEN.

Witnesses:

WM. F. McNAMARA,
ALEX. F. ROBERTS.